WHAT IS CLAIMED IS:

1   1.   A system that emulates a tape cartridge mounted in a tape
2   drive, the system comprising:

3   at least one storage appliance operative to emulate the tape drive and
4   a plurality of virtual volumes mountable in the tape drive; and

5   an interface manager in communication with the at least one storage
6   appliance and in communication with the client using an interface protocol that
7   defines a plurality of addresses, the interface manager being operative to control
8   mounting of the plurality of virtual volumes in the tape drive to emulate the tape
9   cartridge mounted in the tape drive, wherein the tape cartridge has a plurality of
10   virtual addresses at least as great in number as the plurality of addresses defined by
11   the interface protocol.

1   2.   The system of claim 1 wherein the interface manager
2   comprises:

3   a client controller in communication with the client using the interface
4   protocol; and

5   a storage appliance controller in communication with the client
6   controller and the at least one storage appliance, the storage appliance controller
7   being operative to control mounting of the plurality of virtual volumes in the tape
8   drive to emulate the tape cartridge mounted in the tape drive.

1   3.   The system of claim 2 wherein the interface manager further
2   comprises an address map in communication with the client controller and the storage
3   appliance controller, the address map being operative to map the plurality of
4   addresses defined by the interface protocol into the plurality of virtual addresses of
5   the tape cartridge.

4. The system of claim 3 wherein the plurality of virtual addresses exceed in number the plurality of addresses defined by the interface protocol, the interface manager further comprising an overwrite controller in communication with the address map and the client controller, the overwrite controller being responsive upon receiving a write message having a selected address of the plurality of addresses, while the tape cartridge already stores existing data at the selected address, to re-map the selected address to a virtual address of the plurality of virtual addresses unmapped to any of the plurality of addresses, to preserve the existing data.

3 5. The system of claim 4 wherein the interface manager further comprises a log file in communication with the overwrite controller to record re-mapping operations to provide traceability back to the existing data for each re-mapped address of the plurality of addresses.

4 6. The system of claim 2 wherein the at least one storage appliance communicates using a second interface protocol, the interface manager further comprises a protocol converter in communication between the client controller and the storage appliance controller to convert between the interface protocol and the second interface protocol.

5 7. The system of claim 2 wherein the interface manager further comprises a policy controller in communication with the storage appliance controller, the policy controller being operative to control at least one performance parameter of the tape drive and the tape cartridge being emulated to provide variable levels of service to the client.

6 8. The system of claim 2 wherein the at least one storage appliance emulates the tape drive using an actual tape drive.

7 9. The system of claim 2 wherein the at least one storage appliance emulates the plurality of virtual volumes using at least one actual tape cartridge.

1   10.   A method of operation comprising:

2   emulating a tape drive having an interface protocol that defines a
3 plurality of addresses;

4   emulating a plurality of virtual volumes mountable in the tape drive
5 to provide storage capacity; and

6   mounting the plurality of virtual volumes one at a time in the tape
7 drive to emulate a tape cartridge mounted in the tape drive, wherein the tape
8 cartridge has a plurality of virtual addresses at least as great in number as the
9 plurality of addresses defined in the interface protocol in response to emulating the
10 plurality of virtual volumes.

1   11.   The method of claim 10 further comprising mapping the
2 plurality of addresses defined by the interface protocol into the plurality of virtual
3 addresses respectively to link each address of the plurality of addresses to a
4 respective one of the virtual addresses of the plurality of virtual addresses.

1   12.   The method of claim 11 further comprising determining a first
2 virtual volume of the plurality of virtual volumes associated with a first virtual
3 address of the plurality of virtual addresses that is mapped to a selected address of
4 the plurality of addresses in response to receiving the selected address from the
5 client, to identify which part of the tape cartridge is being addressed by the client.

1   13.   The method of claim 12 further comprising mounting the first
2 virtual volume of the plurality of virtual volumes in response to determining the first
3 virtual volume associated with the first virtual address, to make the tape cartridge
4 accessible to the client at the selected address.

1   14.   The method of claim 13 wherein the plurality of virtual
2 addresses exceeds in number the plurality of addresses defined the interface protocol,

3   the method further comprising re-mapping the selected address to a virtual address

4   of the plurality of virtual addresses unmapped to any of the plurality of addresses in

5   response to receiving a write message having the selected address while the tape

6   cartridge already stores existing data at the selected address, to preserve the existing

7   data.

1   15.   The method of claim 14 further comprising logging the re-

2   mapping of the selected address in response re-mapping the selected address to

3   provide traceability back to the existing data for each re-mapped address.

1   16.   The method of claim 10 wherein the emulation of the tape

2   drive and the plurality of virtual volumes is performed by at least one storage

3   appliance that communicates using a second interface protocol, the method further

4   comprising translating between the interface protocol and the second interface

5   protocol to isolate the second protocol from the client.

1   17.   The method of claim 10 further comprising controlling at least

2   one performance parameter of the tape drive and tape cartridge being emulated to

3   provide variable levels of service to the client.

1   18.   The method of claim 10 wherein emulating the tape drive is

2   providing an actual tape drive.

1   19.   The method of claim 10 wherein emulating the plurality of

2   virtual volumes is providing at least one actual tape cartridge.